

than can be achieved with SL mix, although specificity is low.⁷

Ten cases of *D. viscosa*-induced ACD have been published. As in our case, those reports described positive patch testing to fragments of the plant. Additionally, positive reactions to extracts from other plant and to substances included in the perfumes series were observed in some cases, which supports the high probability of crossreactions.^{8,9} Negative patch testing to SLs, as in our case, does not exclude the diagnosis because of the test's low sensitivity.

The study of plant-induced ACD is a significant challenge, mainly because the majority of patients do not identify the specific trigger. This is further complicated by the high probability of crossreactions with substances obtained from other plants and the low specificity of standardized tests. The specific substance to which the patient has been exposed, if it can be identified, must be included in the study, avoiding tests with fresh plants or plant extracts due to the high risk of irritation or sensitization.⁹ We also draw attention to the importance of studying healthy controls using the same techniques, in order to classify the type of reaction as allergic or irritant.

This case highlights the need for dermatologists to recognize this type of reaction and the difficulties that can arise during its investigation.

References

1. Rozas-Muñoz E, Lepoittevin JP, Pujol RM, Giménez-Arnau A. Allergic contact dermatitis to plants: Understanding the chemistry will help our diagnostic approach. *Actas Dermosifiliogr.* 2012;103:456–77.
2. Chadwick M, Trewin H, Gawthrop F, Wagstaff C. Sesquiterpenoids lactones: Benefits to plants and people. *Int J Mol Sci.* 2013;14:12780–805.
3. Amorim MH, Gil da Costa RM, Lopes C, Bastos MM. Sesquiterpene lactones: Adverse health effects and toxicity mechanism. *Crit Rev Toxicol.* 2013;43:559–79.
4. Mensing H, Kimmig W, Hausen BM. Airborne contact dermatitis. *Hautart.* 1985;36:398–402.
5. Salapovic H, Geier J, Reznicek G. Quantification of sesquiterpene lactones in Asteraceae plant extracts: Evaluation of their allergenic potential. *Sci Pharm.* 2013;81:807–18.
6. Ducombs G, Benezra C, Talaga P, Andersen KE, Burrows D, Camarasa JG, et al. Patch testing with the sesquiterpene lactone mix: A marker for contact allergy to Compositae and other sesquiterpene-lactone-containing plants. A multicentre study of the EECDRG. *Contact Dermatitis.* 1990;22:249–52.
7. Shum KW, English JS. Allergic contact dermatitis in food handlers, with patch test positive with Compositae mix but negative to sesquiterpene lactone mix. *Contact Dermatitis.* 1998;39:207–8.
8. Gonçalves M, Gonçalves S. Allergic contact dermatitis from *Dittrichia viscosa* (L.) Greuter. *Contact Dermatitis.* 1991;24:40–4.
9. Estrela F, Tapadinhas C, Pereira F. Allergic contact dermatitis from *Dittrichia viscosa* (L.) Greuter. *Contact Dermatitis.* 1995;32:108–9.

A. Calderón-Komáromy,* N. Puente-Pablo, S. Córdoba, J. Borbujo

Servicio de Dermatología, Hospital Universitario de Fuenlabrada, Madrid, Spain

* Corresponding author.

E-mail address: komaromy20@hotmail.com

(A. Calderón-Komáromy).

Interaction between *Pseudomonas aeruginosa* and Dermatophyte Fungi: Repercussions on the Clinical Course and Microbiological Diagnosis of Tinea Pedis[☆]



Interacción de *Pseudomonas aeruginosa* y hongos dermatofitos: repercusión en el curso clínico y en el diagnóstico microbiológico de la tinea pedis

To the Editor:

Simultaneous skin infection by *Pseudomonas* and fungi is underdiagnosed. In the context of a complex case of this pathology, we reflect on the interaction between these 2

infectious agents, the mutual influences they exert, and how this circumstance can affect the clinical course and microbiological diagnosis.

We present the case of a 55-year-old man who consulted for cellulitis of the right lower limb with marked



Figure 1 Intense erythema and maceration, with peripheral peeling in the fourth interdigital space.

[☆] Please cite this article as: Aspiroz C, Toyas C, Robres P, Gilaberte Y. Interacción de *Pseudomonas aeruginosa* y hongos dermatofitos: repercusión en el curso clínico y en el diagnóstico microbiológico de la tinea pedis. *Actas Dermosifiliogr.* 2016;107:80–82.



Figure 2 Sabouraud dextrose agar with chloramphenicol inoculated with *Trichophyton rubrum* with and without previous seeding with *Pseudomonas aeruginosa*. Incubation for 12 days at 28°C.

systemic repercussions, requiring hospital admission. Physical examination revealed intense erythema of both feet, with desquamation and exudation, particularly in the lateral interdigital spaces, compatible with tinea pedis (Fig. 1), and subungual hyperkeratosis of the nail of the great toes of both feet. Wood light did not elicit fluorescence, allowing us to exclude erythrasma.¹

Routine laboratory tests and a basic study of immunity were normal. Samples taken for microbiology repeatedly grew *Pseudomonas aeruginosa* and other gram-negative bacilli that varied in the different cultures performed (*Proteus mirabilis*, *Escherichia coli*, and *Morganella morganii*). Direct examination of both nails with potassium hydroxide (KOH) showed distorted hyphae, but dermatophytes were not isolated in any of the specific cultures for fungi of the sole of the foot and affected nails. Based on the antibiogram, the patient received treatment with ciprofloxacin for 10 days, leading to an improvement and hospital discharge. During follow-up, the clinical suspicion of interdigital tinea pedis increased, though dermatophytes were not isolated in any of the 3 cultures performed, which always included samples from the sole of the foot and the affected nails. In a fourth culture, performed after complete disappearance of *P. aeruginosa*, the sample from the fourth interdigital space showed growth of *Trichophyton rubrum* and abundant yeasts (*Candida albicans* and *Candida guilliermondii*) were also isolated. The patient was treated with terbinafine, 250 mg/d, for 28 days, leading to clinical and microbiological cure.

Tinea pedis, particularly the interdigital form, is the most common fungal infection.² The warm, moist, and protected anatomic environment predisposes to the proliferation of fungi and gram-negative bacteria. Overgrowth of the normal flora of these spaces provokes maceration, peeling, and the appearance of fissures.

Intertrigo of the foot is usually caused by dermatophytes and yeasts and less commonly by bacteria. Polymicrobial infections are of particular importance, especially when *P. aeruginosa* is involved, as management can be complex, due both to the aggressiveness of the infection, which can produce potentially severe conditions such as cellulitis, and to therapeutic difficulties, because of a high frequency of antimicrobial resistance.³

A major problem with these polymicrobial infections arises from interactions between the different species involved: the presence of fungi in the lesions appears to favor colonization by *P. aeruginosa*,^{4,5} and bacterial overgrowth associated with interdigital infections of the foot can have a fungistatic or fungicidal effect. It has been shown that *P. aeruginosa* is able to inhibit both yeasts (*C. albicans*)^{6,7} and filamentous fungi (*Aspergillus fumigatus*, *Fusarium* species) in vitro.^{2,7,8} Furthermore, this inhibition can occur with various species of *Pseudomonas*, such as *P. aeruginosa* or *P. chlororaphis*, but not with other bacteria, and the effect occurs specifically with the dermatophytes most frequently isolated in tinea pedis, such as *Trichophyton*.^{2,5,6,9}

Returning to our patient, we created a simple in vitro model of the interaction between *P. aeruginosa* and *T. rubrum*. We observed that the dermatophyte did not grow after inoculation into a culture of *P. aeruginosa* (Fig. 2), a finding previously reported by other authors.²

In conclusion, in patients with interdigital tinea pedis that is clinically extensive, intractable, or that recurs after treatment, we must consider possible reasons for diagnostic failure. These may be clinical, when the presence of bacteria is not considered in the diagnosis of tinea pedis, leading to inefficacy of an exclusively antifungal treatment, or microbiological, when the presence of bacteria is not sought or when overgrowth of *P. aeruginosa* is not contemplated as a possible cause of falsely negative dermatophyte culture. The application of a diagnostic protocol that includes systematic use of Wood light for the diagnosis of erythrasma (not forgetting possible mixed fungal infection)¹ and taking samples to search both for fungi (particular dermatophytes, but also yeasts) and for bacteria (especially gram-negative bacteria, including *Pseudomonas*), could help to define the microbiological etiology of the intertrigo and contribute to a reduction in diagnostic failure that will inevitably lead to inadequate treatment (Fig. 3). Finally, it must not be forgotten that, if all these investigations are negative or inconclusive, a biopsy will help to diagnose noninfectious diseases, such as inverse psoriasis or Bowen Disease.¹⁰

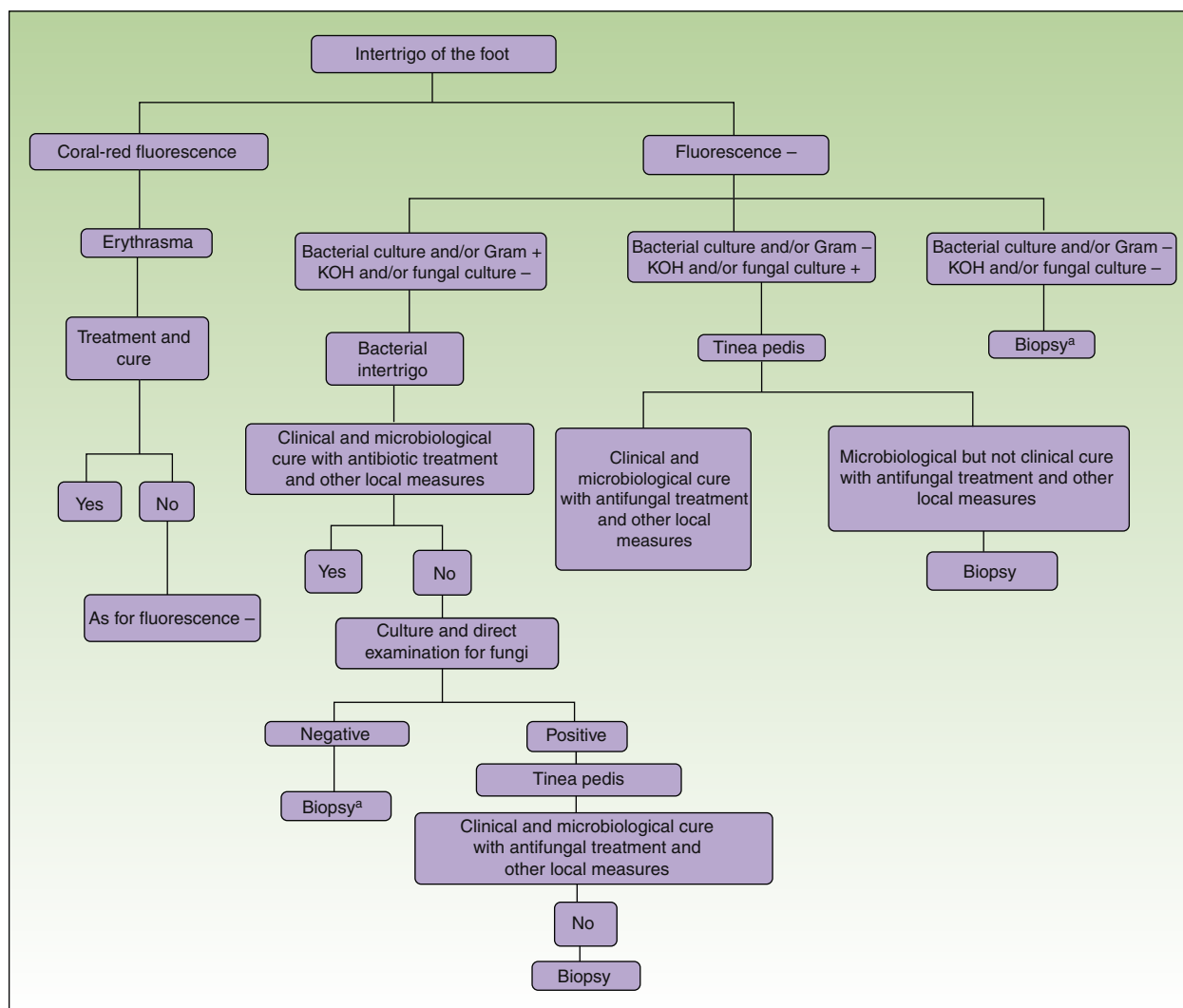


Figure 3 Diagnostic algorithm for intertrigo of the foot.

Other local measures include the application of topical antiseptics, the use of nonocclusive footwear and adequate drying of the affected area after showering or bathing. In addition, antifungal powders should be applied to the footwear to eliminate fungal spores that could provoke reinfection. When taking samples for culture of fungi or bacteria, no topical antifungal or antibiotic agents should have been used for at least 15 days before sampling; in the case of systemic treatments, this period may need to be extended, as some agents remain in the stratum corneum for longer. KOH indicates direct examination with potassium hydroxide.

^a When there is a high clinical suspicion of tinea pedis, empirical treatment with antifungal agents can be started before biopsy, even if direct examination and culture are negative, considering the possibility of a false negative.

Acknowledgments

We would like to thank Dr. Luis Charlez of the Dermatology Department of Hospital Royo Villanova in Saragossa, for his contribution to the diagnosis, treatment, and management of this case.

References

- Morales-Trujillo ML1, Arenas R, Arroyo S. Eritrasma interdigital: datos clínicos, epidemiológicos y microbiológicos. *Actas Dermosifiliogr.* 2008;99:469–73.
- Treat J, James WD, Nachamkin I, Seykora JT. Growth inhibition of *Trichophyton* species by *Pseudomonas aeruginosa*. *Arch Dermatol.* 2007;143:61–4.
- Aste N, Atzori L, Zucca M, Pau M, Biggio P. Gram-negative bacterial toe web infection: A survey of 123 cases from the district of Cagliari, Italy. *J Am Acad Dermatol.* 2001;45:537–41.
- Mermel LA, McKay M, Dempsey J, Parenteau S. *Pseudomonas* surgical-site infections linked to a healthcare worker with onychomycosis. *Infect Control Hosp Epidemiol.* 2003;24:749–52.
- Foster KW, Thomas L, Warner J, Desmond R, Elewski BE. A bipartite interaction between *Pseudomonas aeruginosa* and fungi in onychomycosis. *Arch Dermatol.* 2005;141:1467–8.
- Gorantla JN, Kumar SN, Nisha GV, Sumandu AS, Dileep C, Sudare-san A, et al. Purification and characterization of antifungal

phenazines from a fluorescent *Pseudomonas* strain FPO4 against medically important fungi. *J Mycol Med.* 2014;24:185–92.

7. Kerr JR, Taylor GW, Rutman A, Høiby N, Cole PJ, Wilson R. *Pseudomonas aeruginosa* pyocyanin and 1-hydroxyphenazine inhibit fungal growth. *J Clin Pathol.* 1999;52:385–7.
8. Yang YS, Ahn JJ, Shin MK, Lee MH. *Fusarium solani* onychomycosis of the thumbnail coinfecting with *Pseudomonas aeruginosa*: Report of two cases. *Mycoses.* 2011;54:168–71.
9. Ranjbariyan A, Shams-Ghahfarokhi M, Razzaghi-Abyaneh M. Antifungal activity of a soil isolate of *Pseudomonas chlororaphis* against medically important dermatophytes and identification of a phenazine-like compound as its bioactive metabolite. *J Mycol Med.* 2014;24:e57–64.
10. Selden ST, Flowers F, Vinson RP. Intertrigo Clinical Presentation. Available at: <http://emedicine.medscape.com/article/1087691-workup>.

C. Aspiroz,^a C. Toyas,^b P. Robres,^a Y. Gilaberte^{c,d,*}

^a Servicio de Microbiología, Hospital Royo Villanova, Zaragoza, Spain

^b Servicio de Medicina Interna, Hospital Royo Villanova, Zaragoza, Spain

^c Servicio de Dermatología, Hospital San Jorge, Huesca, Spain

^d Instituto Aragonés de Ciencias de la Salud, Zaragoza, Spain

*Corresponding author.

E-mail addresses: ygilaberte@salud.aragon.es, ygilaberte@gmail.com (Y. Gilaberte).

Acquired Facial Hyperpigmented Macules in Children: 3 New Cases[☆]



Máculas hiperpigmentadas faciales adquiridas en la infancia: 3 nuevos casos

To the Editor:

Acquired hyperpigmented facial macules were recently described in 25 children.¹ This condition is characterized by the appearance of multiple, asymptomatic, hyperpigmented macular lesions on the forehead and in the temporal region with no segmental distribution and without the previous presence of erythema, edema, or desquamation. The mean age at presentation was 6 months (range, 2–24 months). The condition affected children of different races, and there was no history of similar lesions among family members or close contacts. We describe 3 new cases.

Case Descriptions

A 3-year-old girl with no past medical history of interest presented a number of asymptomatic hyperpigmented macules that had arisen spontaneously on the forehead and in the temporal region 4 months earlier (Fig. 1A). The lesions did not present desquamation, Darier sign was negative, and there was no history of inflammation in the affected area. The rest of the physical examination was normal. Her sister aged 2 years, diagnosed with atopic dermatitis, presented macules of similar characteristics in the same areas (Fig. 1B). Onset of the lesions occurred simultaneously in the 2 girls, during the winter months. Likely triggering factors were investigated but no relevant suspicious factors were detected. The other members of the family and closest contacts did not present any lesions. The adhesive tape test revealed no structures suggestive of a superficial mycosis,

but remnants of pink-colored fibrillary structures were found on the surface of the adhesive tape; under polarized light, these fibers appeared synthetic (Fig. 2). At the 12-month follow-up the lesions persisted, but both girls presented a good general state of health, with no symptoms suggestive of systemic alterations.

The third patient was a 1-year-old girl of South American origin. She also presented asymptomatic hyperpigmented macules in the frontotemporal region. The macules had appeared during the first week of life and had remained clinically stable (Fig. 3). Immune studies including antinuclear antibodies and extractable nuclear antigen antibodies were performed on the girl and her mother and were negative.

Skin biopsy was not performed on any of the girls because of their age and the site and benign appearance of the lesions.

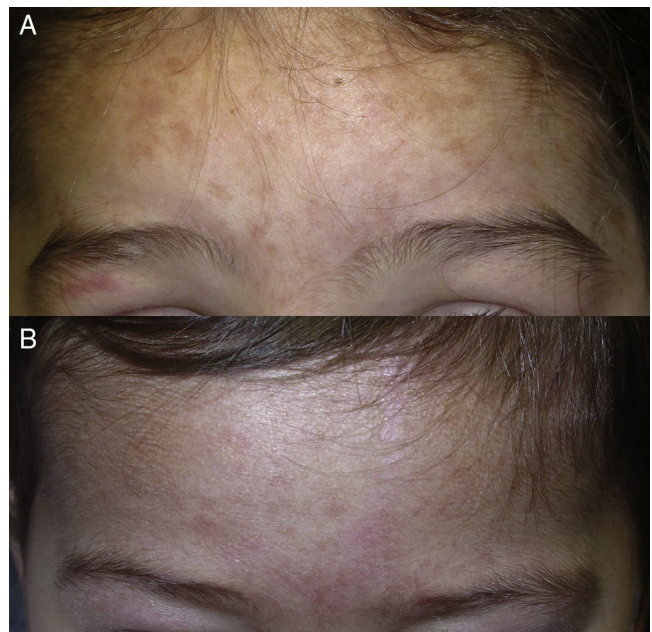


Figure 1 A, Hyperpigmented macules in the frontotemporal region of a 3-year-old white girl. B, The same lesions in her 2-year-old sister.

[☆] Please cite this article as: Giacaman A, Knöpfel N, Campos M, Martín-Santiago A. Máculas hiperpigmentadas faciales adquiridas en la infancia: 3 nuevos casos. *Actas Dermosifiliogr.* 2016;107:83–85.